D-PorCCA, a new tool to study the behaviour of harbour porpoises

71

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BACKGROUND

We can deduce the behaviour of harbour porpoises from their clicking pattern. These behaviours can be broadly divided between: travelling/navigation, foraging/feeding, and socialising/communication (Fig. 1). Available acoustic recordings can be used to better understand porpoise behaviour and find key areas for them (e.g., breeding areas). The aim of this study was to develop an independent tool with the necessary algorithms to study harbour porpoise behaviour in their natural environment.

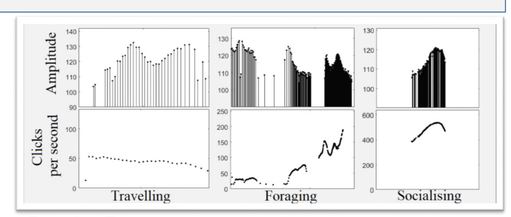

Fig 1. Examples of patterns of click trains depending on behavioural state

D-PorCCA

D-PorCCA is a standalone tool developed in MATLAB. It works on the output of PAMGuard's click detector[1] and includes a new porpoise click classifier (PorCC)[2] and other algorithms necessary to identify porpoise click trains and extract patterns within them to identify behavioural states. The user can inspect click trains, see and download summaries (e.g., day vs night activity, positive porpoise minutes) and extract data for further analysis. Click trains are automatically cleaned from echoes and other noise sources, after which the pattern of the click train is automatically investigated to determine whether there are one or more animals vocalising simultaneously (i.e., overlapping click trains), as well as the behaviour of the animal.

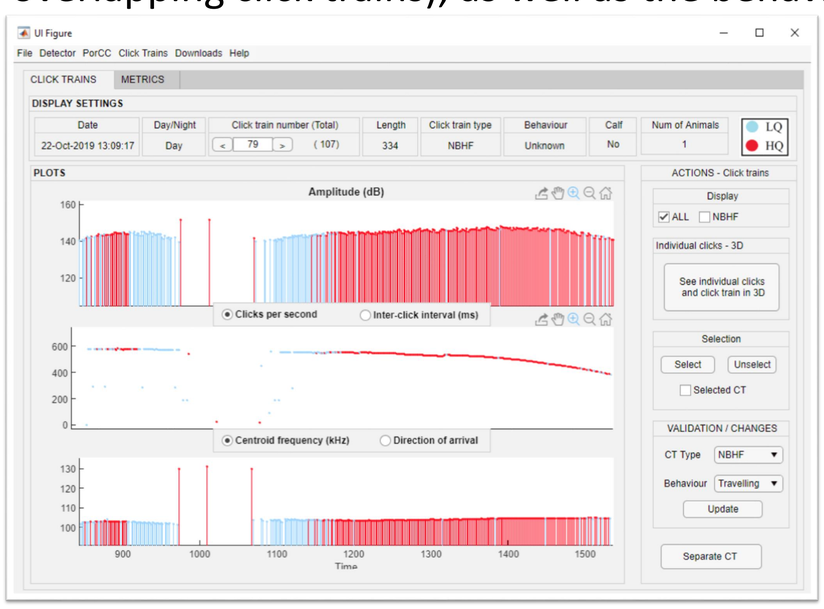

Fig 2. Main page of D-PorCCA. LQ = low quality clicks. HQ = high-quality clicks. Clicks of Heaviside's dolphins.

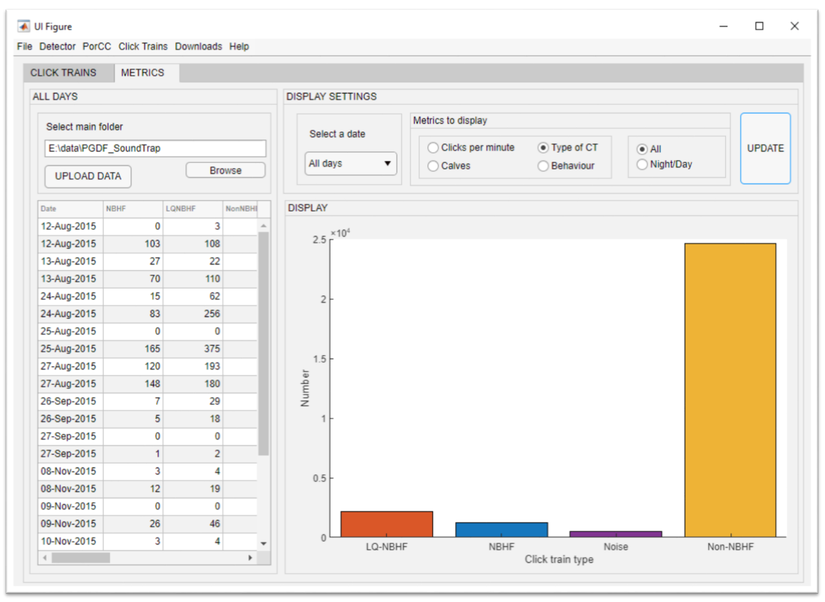

Fig 3. Metrics page of D-PorCCA.

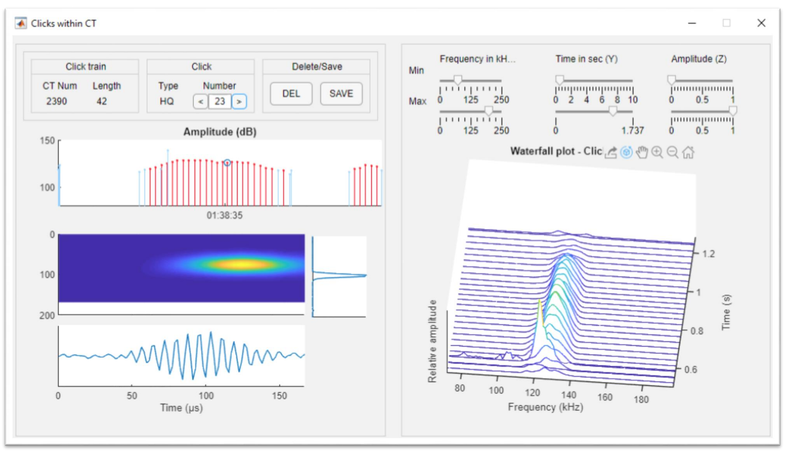

Fig. 4. Individual clicks pop-up panel. Left side: Top: Amplitude variation of click train in time. Middle: spectrogram and, power spectrum. Bottom: waveform. Right side: waterfall plot (3D) of click train.

RESULTS

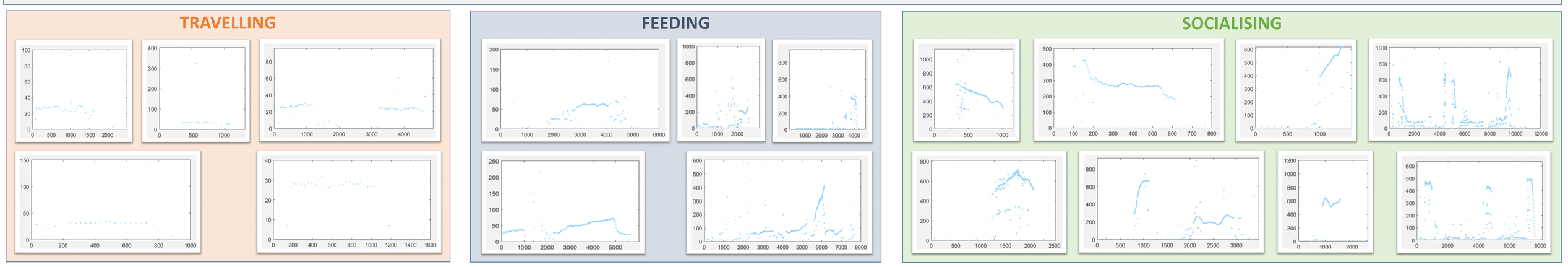

Fig 5. Examples of patterns, which can be used to deduce the main behaviour of the animals using the algorithms in D-PorCCA. Y axis = clicks per second. X axis = time (ms).

CONCLUSIONS

D-PorCCA is a user-friendly tool with potential for behavioural studies and large monitoring projects of wild harbour porpoises as well as other NBHF species. D-PorCCA can be used to fill knowledge gaps of these elusive species.

References: 1) Gillespie D, Gordon JCD, Mchugh R, Mclaren D, Mellinger DK, Redmond P, Thode A, Trinder P, Deng XY. 2009. PAMGUARD: Semiautomated, open source software for real-time acoustic detection and localisation of cetaceans. *Proc Inst Acoust*. 30:2547 2) Cosentino M, Guarato F, Tougaard J, Nairn D, Jackson JC, Windmill JFC. 2019. Porpoise click classifier (PorCC): A high-accuracy classifier to study harbour porpoises (*Phocoena phocoena*) in the wild. *J Acoust Soc Am*. 145(6):3427–3434.. **Acknowledgements**: Data were collected by community volunteers from Clyde Porpoise CIC with assistance from NA Ventures Trust and Firstport. MC was fully funded by an EPSRC studentship (EP/N509760/1). The study was supported with funding from the European Research Council under the European Union's Seventh Framework Programme (FP/2007-2013) / ERC Grant Agreement n. [615030].